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FIFTIETH ANNUAL REPORT

TO THE International Joint Commission

COVERING Calendar Year 2008



International Souris River Board

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INTERNATIONAL SOURIS
RIVER BOARD

CONSEIL INTERNATIONALE
DE LA RIVIERE SOURIS



October 2009

The International Joint Commission
Ottawa, Ontario and Washington, D.C.

Commissioners:

In accordance with the Directive of January 22, 2007 (replaces Directives of April 11, 2002 and May 31, 1959), we have enclosed the Fiftieth Annual Report covering calendar year 2008.

Respectively submitted,

A handwritten signature in black ink that reads "Russell Boals".

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HIGHLIGHTS 2008

For the 2008 calendar year, the natural flow of the Souris River at the Sherwood Crossing was 23 701 cubic decametres (19,214 acre-feet), which represents 18.5 percent of the 1959-2008 long-term mean. During these well below normal conditions North Dakota received 77.5 percent of the natural flow.

Net depletions in Canada were 5 331 cubic decametres (4,322 acre-feet). Recorded runoff for the Souris River near Sherwood, North Dakota, was 16 930 cubic decametres (13,725 acre-feet), or about 15.5 percent of the 1931-2008 long-term mean. The natural flow at Sherwood did not exceed 50 000 cubic decametres (40,535 acre-feet), resulting in a 50/50 sharing of the natural flow at the Sherwood Crossing. The apportionment between Canada and the United States was discussed in the September 25, 2008 teleconference call. Significant rains in May and June and a surplus of water delivered as of August 31 meant no releases were planned from Rafferty and Alameda dams in the fall. Calculations made after the end of the year indicated that Saskatchewan was in surplus to the United States by 6 520 cubic decametres (5,286 acre-feet).

The flow of the Souris River as it enters North Dakota at Sherwood was more than 0.113 cubic metres per second (4 cubic feet per second) except during the periods of January 1 through March 18, May 18-25, and July 12 through the remainder of the year except for short period in November. During those periods when the flow was less than 0.113 cubic metres per second (4 cubic feet per second), the Province of Saskatchewan did not divert, store, or use any water above what would have occurred under conditions of water-use development prevailing in the Saskatchewan portion of the basin prior to the construction of Boundary Dam, Rafferty Dam, and Alameda Dam. Accordingly, Saskatchewan complied with the 0.113 cubic metres per second (4 cubic feet per second) provision specified in Recommendation No. 1 of the Interim Measures.

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 46 cubic decametres (37 acre-feet), or 0.2 percent of the long-term mean since 1959. Recommendation No. 2 of the Interim Measures was met with a net gain in the North Dakota portion of the Long Creek basin of 159 cubic decametres (129 acre-feet).

Recorded runoff leaving the United States at Westhope during the period of June 1 through October 31, 2008, was 10 994 cubic decametres (8,913 acre-feet). The flow was in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures except for the periods of June 1 through June 16, July 13 through August 2, and August 31 through September 30.

In 2007, calculations made after the end of the year indicated that Saskatchewan was in deficit to the United States by 1 773 cubic decametres (1,437 acre-feet). The International Souris River Board (Board) agreed that this deficit would be addressed in 2008. With the surplus received by the United States in 2008, the Board agreed that the deficit from 2007 had been addressed.

The water quality of the Souris River in calendar year 2008 was similar to prior years. The principle water quality concerns in the Souris River basin relate to elevated concentrations of total dissolved solids (TDS), depleted dissolved oxygen and high levels of nutrients especially phosphorus. The dissolved oxygen concentration at both border stations fell to a level that is harmful to most aquatic life.

In addition to overseeing water apportionment, the International Souris River Board maintains a watching brief of basin water-development projects, such as the Northwest Area Water Supply Project. As well, the Board fosters the sharing of flow forecasting and reservoir operation information amongst interested groups in the basin.

1.0 INTERNATIONAL SOURIS RIVER BOARD

1.1 SOURIS RIVER REFERENCE (1940)

The following excerpt describes the history of the water-apportionment program that the International Souris River Board currently maintains:

In a letter on behalf of the Government of Canada dated 20 March 1959 and a letter on behalf of the Government of the United States of America dated 3 April 1959, the International Joint Commission was informed that the Interim Measures recommended in its report of 19 March 1958, in substitution for those recommended in the report dated 2 October 1940 in response to the Souris River Reference (1940), had been accepted by both Governments.

The Governments of the United States and Canada entered into an Agreement for Water Supply and Flood Control in the Souris River Basin on October 26, 1989. Pursuant to this Agreement, the Interim Measures related to the sharing of the annual flow of the Souris River from Saskatchewan into North Dakota contained in paragraph 22(1) of the Commission's 1958 Report to the Governments were modified. In light of the modifications in 1989 and pursuant to a February 28, 1992, request from the Governments of the United States and Canada, the Commission, on April 23, 1992, directed the International Souris River Board of Control to begin applying the "Interim Measures as Modified in 1992." The measures were further modified by the Governments in December 2000. The "Interim Measures as Modified in 2000" are shown in Appendix C of this report.

1.2 INTERIM MEASURES AS MODIFIED IN 2000

In December 2000, the International Joint Commission directed the Board to implement the "Interim Measures as Modified in 2000" for the 2001 calendar year and each year thereafter. The 2000 Interim Measures, shown in Appendix C, were developed to provide greater clarification of the conditions that must prevail for the determination of the share of natural flow between Saskatchewan and North Dakota at the Sherwood Crossing.

In general, the Interim Measures provide that Saskatchewan shall have the right to divert, store, and use waters that originate in the Saskatchewan portion of the Souris River basin, provided that the annual runoff of the river into North Dakota is not thereby reduced to less than half of the runoff that would have occurred in a state of nature; that North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the basin together with the waters that cross the boundary from Saskatchewan; and that Manitoba shall have the right to use the waters that originate in the Manitoba portion of the basin and, in addition, that North Dakota must provide to Manitoba, except during periods of severe drought, a regulated flow of 0.566 cubic metres per second (20 cubic feet per second) during the months of June through October.

For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall as far as practicable regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metres per second (4 cubic feet per second) when that level of flow would have occurred under the conditions of water-use development prevailing in the Saskatchewan portion of the drainage basin prior to the construction of Boundary Dam, Rafferty Dam, and Alameda Dam.

Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when those conditions occur, the minimum flow actually passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control.

Except in flood years, flow releases to the United States should occur in the pattern that would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the International Souris River Board that the release would not be of benefit to the State at that time.

The State of North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing, provided that any diversion, use, or storage of Long Creek water shall not diminish the annual runoff at the Eastern Crossing of Long Creek into Saskatchewan below the annual runoff of Long Creek at the Western Crossing into North Dakota.

In periods of severe drought, when it becomes impracticable for North Dakota to deliver the regulated flow of 0.566 cubic metre per second (20 cubic feet per second), North Dakota's responsibility to Manitoba will be limited to providing such flows as the Board determines to be practicable and in accordance with the objective of making water available for human and livestock consumption as well as for household use.

1.3 BOARD OF CONTROL

At its meeting in May 1959, the International Joint Commission officially approved and signed a directive that created the International Souris River Board of Control. At that time, the Board was charged with the responsibility of ensuring compliance with the Interim Measures set out and of submitting to the Commission such reports as the Commission may require or as the Board at its discretion may desire to file.

1.4 AMALGAMATION OF THE INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD AND INTERNATIONAL SOURIS RIVER BOARD OF CONTROL

In 2000, the International Joint Commission directed the International Souris-Red Rivers Engineering Board to transfer its responsibilities that related to the Souris River to the International Souris River Board of Control. The Commission also changed the International Souris River Board of Control's name to the International Souris River Board.

1.5 AMALGAMATION OF THE INTERNATIONAL SOURIS RIVER BOARD AND SOURIS RIVER BI-LATERAL WATER QUALITY MONITORING GROUP

In 2006 the International Joint Commission changed the Board's mandate. Because of the change in the mandate and the desire of the Commission to move to a more encompassing watershed approach, the Board was requested to develop a Directive based on existing Commission responsibilities in the Souris River basin that would move toward an enhanced mandate for the Board. By letter dated January 22, 2007, the International Souris River Board was officially notified by the Commission that the new directive dated January 18, 2007, replaced the previous directive dated April 11, 2002. The

new Directive sets out the duties of the Board as it moves toward a watershed approach in the Souris River basin and combined the duties of the International Souris River Board and Souris River Bi-Lateral Water Quality Monitoring Group. It also increased the membership of the Board to twelve members.

The Board's duties were revised to include the following:

- Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.
- Oversee the implementation of compliance with the Interim Measures as Modified for Apportionment of the Souris River as described in Appendix A of the Directive.
- Assist the Commission in the review of a Joint Water Quality Monitoring Program.
- Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.
- Report on aquatic ecosystem health issues in the watershed and regularly inform the Commission on the state and implications of aquatic ecosystem health.
- Carry out such other studies or activities as the Commission may, from time to time, request.
- Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year.
- The Board shall submit an annual report covering all of its activities at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive.
- The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year. The Board has agreed to hold the public meeting in the spring/summer and to advertise it.

The Board continued to adjust its governance structure in 2007. Two committees have been established to assist with administering the conditions of its mandate. The Natural Flow Methods Committee is charged with investigating procedures and questions on the approach and methods used to determine the natural flow of the Souris River basin. The Flow Forecasting Liaison Committee has the responsibility to ensure there is information sharing and coordination between the forecasting agencies in the basin. Membership on these committees includes all affected agencies in the basin. An Ecosystem Health Committee is under consideration.

1.6 BOARD MEMBERS

At the end of 2008, the members of the International Souris River Board were as follow:

Dale Frink North Dakota State Engineer Bismarck, North Dakota	Member for the United States (Co-Chair)
Col. Jonathan Christensen U.S. Army Corps of Engineers St. Paul, Minnesota	Member for the United States
Gregg Wiche U.S. Geological Survey Bismarck, North Dakota	Member for the United States
Megan Estep U.S. Fish and Wildlife Service Denver, Colorado	Member for the United States
Dennis Fewless North Dakota Department of Health Bismarck, North Dakota	Member for the United States
Scott Gangl North Dakota Game and Fish Department Bismarck, North Dakota	Member for the United States
Russell Boals Environment Canada Regina, Saskatchewan	Member for Canada (Co-Chair)
Robert Harrison Manitoba Water Stewardship Winnipeg, Manitoba	Member for Canada
Doug Johnson Saskatchewan Watershed Authority Moose Jaw, Saskatchewan	Member for Canada
Richard Zitta Saskatchewan Environment Regina, Saskatchewan	Member for Canada
Dwight Williamson Manitoba Water Stewardship Winnipeg, Manitoba	Member for Canada

2.0 2008 ACTIVITIES OF THE BOARD

Since the presentation of the Forty-Sixth Annual Report to the International Joint Commission, the International Souris River Board has held two meetings and has had one teleconference call. The discussions and decisions made are summarized in the following sections.

2.1 FEBRUARY 27, 2008, MEETING IN WINNIPEG, MANITOBA

Members in attendance were:

Dale Frink	Member for the United States
Col. Jonathan Christensen	Member for the United States
Megan Estep	Member for the United States
Dennis Fewless	Member for the United States
Russell Boals	Member for Canada
Dwight Williamson	Member for Canada
Doug Johnson	Member for Canada

A summary of the natural flow computations for the period of January 1 through December 31, 2007, was presented at the February 27, 2008, meeting. The final apportionment balance for the 2007 calendar year showed that Saskatchewan was in deficit to North Dakota by 1 773 cubic decametres (1,437 acre-feet).

Hydrologic conditions in Saskatchewan in 2007 were at or slightly below normal. The Saskatchewan Watershed Authority forecasted below normal runoff for the Saskatchewan portion of the Souris basin as of February 1, 2008

The Saskatchewan Watershed Authority reported that SaskPower would be rebuilding the spillway for Boundary Reservoir in 2008. Flows would be diverted to Rafferty using the Boundary to Rafferty Diversion. Repairs to the gates on both Rafferty and Alameda Dams would be done in the summer of 2008 as well.

Due to these repairs it was estimated that 16,000 dam³ would be released from Alameda Reservoir. It estimated that this release would result in an over-delivery of 7,000 cubic decametres or about 73% of the best estimate of the 90-day natural flow at the International Boundary.

The Natural Flow Methods Committee (NFMC) was to meet in the fall of 2007 to review the United States Fish and Wildlife Service's (USFWS) proposed changes to Lake Darling operating levels and to provide a report to the ISRB with potential implications. It reported that the NFMC did not meet. It was noted that until such a review is conducted the USFWS will not be changing operating levels.

The Flow-Forecasting Liaison Committee reported that the Environment Canada network of climate stations has been significantly reduced. It was noted that there is a new network of real-time weather sites being developed as a result of a joint venture between WeatherBug and the Canadian Wheat Board.

A proposed water quality monitoring plan for the Souris River at Westhope for 2008-2009 was presented to the Board. The plan included the number of samples to be collected by month, analytical parameters, and schema. They noted that Environment Canada currently samples for Total Coliform, Fecal Coliform, and Fecal Strep. It was suggested that Total Coliform be replaced with E. Coli sampling as North Dakota has switched to E. Coli as per the United States Environmental Protection Agency standard. It was noted that E. Coli is likely a much better indicator for changes pertaining to human activity and agricultural activity. A decision on the switch from total coliform to E. Coli was referred to the Aquatic Ecosystem Health Committee (AEHC). It was suggested that the AEHC review water quality objectives as well.

A water quality model is being developed that will provide a total maximum daily load (TMDL) for the upper Souris River basin in North Dakota. Winter anoxia near Sherwood has been an issue since 1999.

The Water Quality Annual Report for 2003-2005 has not been completed due to human resource shortfalls and other priorities.

The Board agreed that a Flow Forecasting Liaison Committee is still required but the Terms of Reference need to be updated.

The Board agreed that an Aquatic Ecosystem Health Committee should be established.

It was suggested that each committee have one Board member to provide a link from the committee to the Board.

A suggestion was made that the NFMFC be re-named to the Hydrology Committee as its mandate has grown beyond focusing only on natural flow.

International Souris River Board members discussed the need for a procedures manual documenting the methods used to compute natural flows for the Souris River at Sherwood. Environment Canada is working with the Natural Flows Methods Committee to develop a procedures manual.

2.2 JUNE 20, 2008, MEETING IN BRANDON, MANITOBA

Members of ISRB in attendance were:

Russell Boals
Member for Canada

Dale Frink
Member for the United States

Doug Johnson
Member for Canada

Megan Estep
Member for the United States

Richard Zitta
Member for Canada

Col. Jonathan Christensen
Member for the United States

Robert Harrison
Member for Canada

Spring runoff in 2008 was below normal in the Saskatchewan portion of the Souris River basin. There was very little runoff in the Long Creek and upper Souris River basins. Marginal flows were recorded in the lower Souris River and Moose Mountain Creek basins. Precipitation throughout the basin was below normal from March through May. Rain in mid-June provided minor runoff in the lower Souris River and Moose Mountain Creek basins.

Spring runoff in the North Dakota portion of the basin was well below normal. The majority of the precipitation occurred in May and June resulting in increased flows in the Souris River below Lake Darling. Lake Darling was at elevation 1590.41 msl on June 1. Concerns were raised regarding the 20 cfs (0.57 m³/s) minimum flow requirement to Manitoba. The concrete spillway and carp barrier at Pool 357 are 3.5 feet (1.06 metres) higher than they should be, making it difficult to maintain sufficient head in Pool 357 to meet and maintain the required minimum flow.

In the Souris River basin in Manitoba, below average soil moisture in the fall of 2007 and below average winter and spring precipitation resulted in very little spring runoff with peak flows and stages the lowest since 1991. Near zero flows were observed in the Souris River in April and May. Conditions in the Souris River improved in June due to heavy rainfall and releases from J. Clark Salyer National Wildlife Refuge.

A summary of the interim natural flow computations for the period of January 1 through May 31, 2008, was presented at the June 20, 2008, meeting. The computed natural flow at the Sherwood Crossing for the period was 20 183 cubic decametres (16,362 acre-feet). The United States share on a 50/50 basis was 10 090 cubic decametres (8,180 acre-feet). The United States had received 16 145 cubic decametres (13,089 acre-feet) during the 5-month period resulting in a surplus of 6 055 cubic decametres (4,909 acre-feet). The surplus does not include the 1 773 cubic decametres (1,437 acre-feet) of water received to cover the deficit from 2007. The International Souris River Board accepted the compilation of flows and the computed apportionment balance for the period of January 1 through May 31, 2008.

Water quality sampling at Sherwood has been reduced from 9 samples to 7 samples as a result of a statistical analysis that indicated 7 samples would be sufficient. The program for Westhope is for 8 samples to be collected with one under ice. Consideration is being given to adding one more sample in the winter to obtain a better understanding of ammonia build-up.

2.3 SEPTEMBER 25, 2008, TELECONFERENCE CALL

Members in attendance were:

Russell Boals
Member for Canada

Robert Harrison
Member for Canada

Doug Johnson
Member for Canada

Dale Frink
Member for the United States

Gregg Wiche
Member for the United States

Megan Estep
Member for the United States

Scott Gangl
Member for the United States

The purpose of the teleconference call was to review the flow conditions and discuss the apportionment balance of the Souris River for the period of January 1 through August 31, 2008. Significant rains in May and June had reduced the 6 055 cubic decametres (4,909 acre-feet) surplus to North Dakota on May 31, 2008, to 6 520 cubic decametres (5,286 acre-feet) surplus by August 31, 2008. The Board determined that the surplus and the current flow in the river would satisfy apportionment obligations for 2008 at the Sherwood Crossing.

3.0 MONITORING

3.1 INSPECTIONS OF THE BASIN

During the year, the staff of the Water Survey Division of Environment Canada, Saskatchewan Watershed Authority, the North Dakota State Water Commission, Manitoba Water Stewardship, and the U.S. Geological Survey carried out frequent field inspections of the Souris River basin.

3.2 GAUGING STATIONS

A list of the gauging stations being operated in the Souris River basin is given in Table 1. In addition, the U.S. Geological Survey operated three miscellaneous stream flow-measurement sites in the vicinity of the Eaton Irrigation Project near Towner, North Dakota.

The station numbers and the locations of the hydrometric stations measuring streamflow are shown in Part I of Table 1. The gauging station numbers and the locations of the hydrometric stations located on lakes and reservoirs in the basin are shown in Part II of Table 1.

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN.
Part I--Streamflow

Index number	Stream	Location	State or province	Operated by
05NA003 (05113360)	Long Creek ¹	at Western Crossing	Saskatchewan	Environment Canada
05NA004	Long Creek	near Maxim	Saskatchewan	Saskatchewan Watershed Authority
05NA005	Gibson Creek	near Radville	Saskatchewan	Environment Canada
05NB001	Long Creek	near Estevan	Saskatchewan	Environment Canada
05NB011	Yellowgrass Ditch	near Yellowgrass	Saskatchewan	Environment Canada
05NB014	Jewel Creek	near Goodwater	Saskatchewan	Environment Canada
05NB017	Souris River	near Halbrite	Saskatchewan	Environment Canada
05NB018	Tatagwa Lake Drain	near Weyburn	Saskatchewan	Environment Canada
05NB021 (05113800)	Short Creek ¹	near Roche Percee	Saskatchewan	Environment Canada
05NB031	Souris River	near Bechard ²	Saskatchewan	Saskatchewan Watershed Authority
05NB033	Moseley Creek	near Halbrite	Saskatchewan	Environment Canada
05NB034	Roughbark Creek	near Goodwater	Saskatchewan	Environment Canada
05NB035	Cooke Creek	near Goodwater	Saskatchewan	Environment Canada

05NB036	Souris River	below Rafferty Reservoir	Saskatchewan	Environment Canada
05NB038	Boundary Reservoir Diversion Canal	near Estevan	Saskatchewan	Environment Canada
05NB039	Tributary	near Outram	Saskatchewan	Environment Canada
05NB040	Souris River	near Ralph	Saskatchewan	Environment Canada
05NB041	Roughbark Creek	above Rafferty Reservoir	Saskatchewan	Environment Canada
05NC001	Moose Mountain Creek	below Moose Mountain Lake	Saskatchewan	Saskatchewan Watershed Authority
05ND004	Moose Mountain Creek	near Oxbow	Saskatchewan	Environment Canada
05ND010	Moose Mountain Creek	above Alameda Reservoir	Saskatchewan	Environment Canada
05ND011	Shepherd Creek	near Alameda	Saskatchewan	Environment Canada
05NE003	Pipestone Creek	above Moosomin Reservoir	Saskatchewan	Environment Canada
05NF001	Souris River	at Melita	Manitoba	Environment Canada
05NF002	Antler River	near Melita	Manitoba	Environment Canada
05NF006	Lightning Creek	near Carnduff	Saskatchewan	Environment Canada
05NF007	Gainsborough Creek	near Lyleton	Manitoba	Environment Canada
05NF008	Graham Creek	near Melita	Manitoba	Environment Canada
05NF010	Antler River	near Wauchope	Saskatchewan	Environment Canada
05NG001	Souris River	at Wawanesa	Manitoba	Environment Canada
05NG003	Pipestone Creek	near Pipestone	Manitoba	Environment Canada
05NG007	Plum Creek	near Souris	Manitoba	Environment Canada
05NG012	Elgin Creek	near Souris	Manitoba	Environment Canada
05NG020	Medora Creek	near Napinka	Manitoba	Environment Canada
05NG021	Souris River	at Souris	Manitoba	Environment Canada
05NG024	Pipestone Creek	near Sask. Boundary	Manitoba	Environment Canada
05113520	Long Creek Tributary	near Crosby	North Dakota	U.S. Geological Survey
05113600	Long Creek ^{1 3}	near Noonan	North Dakota	U.S. Geological Survey
(05NB027)				
05114000	Souris River ^{1 3}	near Sherwood	North Dakota	U.S. Geological Survey
(05ND007)				
05116000	Souris River ³	near Foxholm	North Dakota	U.S. Geological Survey
05116135	Tasker Coulee Tributary	near Kenaston	North Dakota	U.S. Geological Survey
05116500	Des Lacs River ³	at Foxholm	North Dakota	U.S. Geological Survey
05117500	Souris River ³	above Minot	North Dakota	U.S. Geological Survey
05119410	Bonnes Coulee	near Velva	North Dakota	U.S. Geological Survey
05120000	Souris River ³	near Verendrye	North Dakota	U.S. Geological Survey
05120180	Wintering River Tributary	near Kongsberg	North Dakota	U.S. Geological Survey
05120500	Wintering River ³	near Karlsruhe	North Dakota	U.S. Geological Survey
05122000	Souris River ³	near Bantry	North Dakota	U.S. Geological Survey
05123300	Oak Creek Tributary	near Bottineau	North Dakota	U.S. Geological Survey
05123400	Willow Creek ³	near Willow City	North Dakota	U.S. Geological Survey
05123510	Deep River ³	near Upham	North Dakota	U.S. Geological Survey
05124000	Souris River ^{1 3}	near Westhope	North Dakota	U.S. Geological Survey
(05NF012)				

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN.
Part II--Water Level

Index number	Stream	Location	State or province	Operated by
05113750	East Branch Short Creek Reservoir	near Columbus	North Dakota	U.S. Geological Survey
05115500	Lake Darling	near Foxholm	North Dakota	U.S. Geological Survey
LGNN8	Souris River	at Logan	North Dakota	U.S. Corps of Engineers U.S. N. Weather Service
SWRN8	Souris River	at Sawyer	North Dakota	U.S. Corps of Engineers U.S. N. Weather Service
TOWN8	Souris River	at Towner	North Dakota	U.S. Corps of Engineers U.S. N. Weather Service
VLVN8	Souris River	at Velva	North Dakota	U.S. Corps of Engineers U.S. N. Weather Service
	Upper Souris Refuge	Dams 87 and 96	North Dakota	U.S. Fish and Wildlife
	Des Lacs Refuge	Units 1 - 8 inclusive	North Dakota	U.S. Fish and Wildlife
	J. Clark Salyer Refuge	Dams 320, 326, 332, 341, and 357	North Dakota	U.S. Fish and Wildlife
05NA006	Larsen Reservoir	near Radville	Saskatchewan	Environment Canada
05NB012	Boundary Reservoir	near Estevan	Saskatchewan	Saskatchewan Watershed Authority
05NB016	Roughbark Reservoir	near Weyburn	Saskatchewan	Environment Canada
05NB020	Nickle Lake	near Weyburn	Saskatchewan	Environment Canada
05NB032	Rafferty Reservoir	near Estevan	Saskatchewan	Environment Canada
05NC002	Moose Mountain Lake	near Corning	Saskatchewan	Environment Canada
05ND008	White Bear (Carlyle) Lake	near Carlyle	Saskatchewan	Saskatchewan Watershed Authority
05ND009	Kenosee Lake	near Carlyle	Saskatchewan	Saskatchewan Watershed Authority.
05ND012	Alameda Reservoir	near Alameda	Saskatchewan	Environment Canada
05NE002	Moosomin Lake	near Moosomin	Saskatchewan	Environment Canada
05NF804	Metigoshe Lake	near Metigoshe	Manitoba	Manitoba Water Stewardship
05NF805	Sharpe Lake	near Deloraine	Manitoba	Manitoba Water Stewardship
05NG023	Whitewater Lake	near Boissevain	Manitoba	Environment Canada
05NG801	Plum Lake	above Deleau Dam	Manitoba	Manitoba Water Stewardship
05NG803	Elgin Reservoir	near Elgin	Manitoba	Manitoba Water Stewardship
05NG806	Souris River	above Hartney Dam	Manitoba	Manitoba Water Stewardship
05NG807	Souris River	above Napinka Dam	Manitoba	Manitoba Water Stewardship
05NG809	Plum Lake	near Findlay	Manitoba	Manitoba Water Stewardship
05NG813	Oak Lake	at Oak Lake Resort	Manitoba	Manitoba Water Stewardship
05NG814	Deloraine Reservoir	near Deloraine	Manitoba	Manitoba Water Stewardship

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN.

Part III--Water Quality

Index number	Stream	Location	State or province	Operated by
05114000 (05ND007)	Souris River ^{1 3}	near Sherwood	North Dakota	U.S. Geological Survey
05115500	Lake Darling	near Foxholm	North Dakota	U.S. Geological Survey
05116000	Souris River ³	near Foxholm	North Dakota	U.S. Geological Survey
05116500 (380021)	Des Lacs River ³	at Foxholm	North Dakota	U.S. Geological Survey/ N.D. Dept. of Health
05117500 (380161)	Souris River ³	above Minot	North Dakota	U.S. Geological Survey/ N.D. Dept. of Health
05120000 (380095)	Souris River ³	near Verendrye	North Dakota	U.S. Geological Survey/ N.D. Dept. of Health
05122000	Souris River ³	near Bantry	North Dakota	U.S. Geological Survey
05123400	Willow Creek ³	near Willow City	North Dakota	U.S. Geological Survey
05123510	Deep River ³	near Upham	North Dakota	U.S. Geological Survey
	J. Clark Salyer Refuge	Pool 357	North Dakota	U.S. Fish and Wildlife
05124000 (05NF012)	Souris River ^{1 3}	near Westhope (QA)	North Dakota	U.S. Geological Survey

1 International gauging station

2 Formerly published as Souris River below Lewvan

3 Operated jointly for hydrometric and water-quality monitoring

4.0 TRANSBOUNDARY WATER QUALITY OBJECTIVES AND MONITORING

4.1 OVERVIEW OF WATER QUALITY

The water quality of the Souris River at the International Boundary has been monitored by the International Souris River Board (formerly conducted by the Souris River Bilateral Water Quality Monitoring Group) since 1990.

Water quality objectives are established at the two border crossings. When water quality objectives are not achieved such conditions are referred to as “exceedances.” A summary of water quality exceedances for 2008 is reported in Appendix E. Historical data is also included.

The principle water quality concerns in the Souris River basin relate to elevated concentrations of total dissolved solids (TDS), depleted dissolved oxygen and high levels of nutrients especially phosphorus.

A total of 7 samples were collected by the USGS in 2008.

Exceedances of specific water quality objectives at the Saskatchewan/North Dakota boundary include phosphorus, sodium, sulfate, iron, TDS, dissolved oxygen and pH. These results are relatively consistent with previous year’s data.

Total phosphorus exceeded the objective of 0.10 milligrams per liter in 86 percent of the samples. The maximum phosphorus concentration was 1.5 milligrams per liter, which is 15 times the objective. TDS also exceeded the objective of 1,000 milligrams per liter in 29 percent of the samples. Sodium and sulfate represent major constituents in the mineral composition of the Souris River and exceeded objectives 57 percent and 29 percent respectively.

Dissolved oxygen ranged from 1.8 milligrams per liter to 13.6 milligrams per liter. A concentration of less than 5.0 milligrams per liter is considered an exceedance and this occurred in 14 percent of the samples.

A total of 11 samples were collected by Environment Canada in 2008 (February, April, May, June, July, August, September, and November. Ten samples were collected at Westhope which included a triplicate (August 27) and a joint QA/QC with the USGS at Westhope on September 25th. One joint QA/QC sample (September 3rd) was collected with the USGS at Coulter.

Total phosphorus exceeded the objective of 0.10 milligrams per liter for all the 2008 data. The total phosphorus values ranged from 0.23 milligrams per liter on August 27, 2008 to 1.59 milligrams per liter on February 5, 2008.

Sodium exceeded the objective of 100 milligrams per liter for all the reported data at Westhope. The results ranged from 147 milligrams per liter on April 17, 2008 to 1040 milligrams per liter on February 5, 2008.

All the samples exceeded the sulfate objective of 450 grams per liter. They ranged from 530 milligrams per liter on September 25, 2008 to 3490 milligrams per liter on February 5, 2008.

Total iron exceeded the 0.3 milligrams per liter objective on all the samples in 2008. They ranged from 0.323 milligrams per liter on June 11, 2008 to 14.5 milligrams per liter on February 5, 2008.

All the samples exceeded the TDS objective of 1000 milligrams per liter. They ranged from 1093 milligrams per liter on April 17, 2008 to 1595 milligrams per liter on November 26, 2008.

The pH exceeded the upper pH limit of 8.5 on 4 of the 8 samples collected. February, April, May, and September were the only months that were below 8.5 pH. The pH ranged from a low of 7.82 on February 5, 2008 to a high of 8.8 on August 27, 2008.

The dissolved oxygen was only below the 5 milligrams per liter objective on February 5, 2008 and November 26, 2008 with values of 0.47 and 1.29 milligrams per liter. The remaining values ranged from 5.44 to a high of 15.6 on April 17, 2008.

Chloride exceeded the objective of 100 milligrams per liter on February 5, 2008 with a value of 236 milligrams per liter.

Boron exceeded the 0.50 milligrams per liter objective on February 5, 2008 with a value of 0.972 milligrams per liter.

Fecal coliform exceeded the objective of 200/100 milliliters two times. The samples were collected on September 25, 2008 (219) and a QA/QC sample on August 27, 2008. The triplicate samples were (406, 288, 300).

According to the objective for total suspended solids (TSS) of “the lesser of 10 milligrams per liter or 10% over ambient”, the TSS exceeded the objective in 100% of the samples. The values ranged from 29 milligrams per liter on April 17, 2008 to 107 milligrams per liter on November 26, 2008.

Samples were collected for organic analysis in April, May, June and July and only four compounds were detected. Atrazine, 2,4-D, Bromoxynil, DDT and MCPA, and they were all below the water quality objective.

Fish kills were reported by local Manitoba residents in 2008.

4.2 CHANGES TO POLLUTION SOURCES IN 2008

There were no major changes to pollution sources in 2008. The most prevalent source of pollution is nonpoint pollution from agriculture. Agriculture dominates the land use of the Souris River basin, therefore, it can be surmised that contributions of phosphorus and nitrogen are substantial from these sources. Point sources of pollution from the cities of Estevan and Minot have been reduced by advanced wastewater treatment. Smaller cities continue to discharge effluent intermittently.

Future potential changes to water quality and aquatic ecosystem health include energy development, water appropriations that reduce flows, and reservoir operations.

4.3 TREND ANALYSIS REPORT

The latest Trend Analysis report was finalized in 2000 by the Souris River Bilateral Water Quality Monitoring Group. The methodology used was compatible with changes in monitoring frequency and timing.

The group also discussed possible reasons for the increasing and decreasing trends and agreed that further trend analysis would be conducted on the sulfate data and other major ions data. USGS made slight changes to the model in 2003.

4.4 MONITORING PLAN CHANGES

No monitoring changes were implemented for 2008. The 2008 monitoring plan can be found in Appendix F.

4.5 SEDIMENT TOXICITY TESTING

Pollutants entrained in or attached to sediment represent an unassessed component of water quality at the two boundary sites.

The Board will continue to evaluate the various sediment toxicity testing protocols and, eventually, select an appropriate method and conduct tests at some point in the future when resources become available.

4.6 REVISION OF PHOSPHORUS OBJECTIVES

Phosphorus concentrations tend to be high in prairie soils. Under pre-settlement conditions, phosphorus could enter surface water by erosion, transported plant material, and animal activities. Human activities and hydrologic modifications exacerbate phosphorus loadings, which increases primary productivity. This process, called eutrophication has likely been accelerated in the Souris River. Common sources of phosphorus enrichment are municipal effluent, non-point contributions from agriculture, livestock, and hydrologic modifications. Substantial progress has been made in reducing phosphorus loading from Minot and Estevan by incorporating advanced wastewater treatment. Implementation of Best Management Practices on agricultural land, and installing animal waste systems has reduced loadings from these activities.

Dams frequently have a substantial additive affect on phosphorus loading. Large reservoirs that are recently constructed, and have hypolimnic releases, generally contribute high phosphorus loads. Low head dams can contribute to extremely high phosphorus loadings. These reservoirs often inundate nutrient rich prairie soils. The reservoirs often become anoxic during winter, releasing additional phosphorus from bottom sediments. As well, the reservoirs attract waterfowl that contribute large nutrient loadings to the system. The fall waterfowl population frequently moves out of the lower Souris River just prior to ice up. The organic load from waterfowl does not have sufficient time to become assimilated and, therefore, causes an oxygen demand that is not satisfied until the following open water period. Also, decaying vegetation in the off channel area contributes to anoxic conditions. Phosphorus release from the waterfowl contributions, decaying vegetation, and internal loading from the sediments results in significantly higher phosphorus concentrations than if the system was aerobic. Downstream loading at the border is very high, because spring runoff occurs prior to ice out, thereby purging these shallow ponds.

The phosphorus objective was reviewed as it was noted that phosphorus frequently exceeds the objective criterion at both border sites. Phosphorus tends to be quite high in concentration in prairie streams and differentiating between agricultural practices and baseline phosphorus concentrations remain largely unknown. It was decided that, since many initiatives, both in the United States and Canada, are moving forward on nutrient management, that it would be doubtful whether new information could be shed on this issue until the science was further developed. The review noted

that the loading issue of phosphorus to Lake Darling would be important information; however, until a nutrient budget on Lake Darling is completed, the most appropriate course of action is to maintain the present nutrient objective.

The Board will not change the numeric objective of 0.10 milligrams per liter for total phosphorus at the present time and plans to refer the matter to the Aquatic Ecosystem Health Committee, once formed.

4.7 WINTER ANOXIA

Winter anoxic conditions and fish kills in the Souris River basin have been documented on many occasions. Factors contributing to low oxygen levels have not been determined, but some possibilities could be increased sediment oxygen demand, macrophyte decomposition, organic enrichment, ground water influence, photosynthesis suppression, low flow, or dams. A dissolved oxygen concentration of 1.8 milligrams per liter was measured during 2008 at the North Dakota/Saskatchewan boundary and 0.47 milligrams per liter was measured during 2008 at the North Dakota/Manitoba boundary. These measurements were recorded during routine monitoring conducted by the United States Geological Survey and Environment Canada. The areal extent of the anoxia was not determined. The Board agreed to keep a watch on dissolved oxygen conditions and the North Dakota Department of Health and Environment Canada will attempt to collect dissolved oxygen and ammonia samples if low flow conditions prevail during future winters.

The upper portion of the Souris River in North Dakota was listed as impaired in 2004. This designation means this reach of the river needs a total maximum daily load (TMDL) study. The impairment for aquatic life is dissolved oxygen, and the impairment for recreation is fecal coliform bacteria. The study reach is 43.4 miles downstream from the border to Lake Darling. The lower portion of the Souris River in Saskatchewan from Glen Ewen to the border is also included. A final report is expected in 2009.

5.0 WATER-DEVELOPMENT ACTIVITIES IN 2008

5.1 NORTHWEST AREA WATER SUPPLY PROJECT

The Garrison Diversion Municipal, Rural, and Industrial (MRI) water-supply program, passed by the United States Congress on May 12, 1986, as part of the Garrison Diversion Reformation Act of 1986, authorized the appropriation of federal funds for the planning and construction of water-supply facilities throughout North Dakota. An agreement between the North Dakota State Water Commission and the Garrison Conservancy District in 1986 provided a method through which the agencies can request funding for MRI water-system projects from the Secretary of the Interior. On the basis of this agreement, the Northwest Area Water Supply (NAWS) study was initiated in November 1987.

The NAWS project has been designed to supply a reliable source of treated water to cities, communities, and rural water systems in 10 counties in northwestern North Dakota. The project has an estimated cost of \$217 million.

The water supply for the project is Lake Sakakawea, located in the Missouri River system. The annual use authorized under the State of North Dakota water permit is 18 502 dam³ (15,000 acre-feet).

The Environmental Assessment for NAWS was completed with a "Finding of No Significant Impact (FONSI)" and Canada was notified on June 4, 2001. Subsequently, Canada and Manitoba made an Administrative Appeal to the Bureau of Reclamation to carry out a full Environmental Impact Statement. Canada is concerned that the NAWS project could permit the interbasin transfer of non-native biota. On September 10, 2001, Canada was informed that the appeal was rejected.

The project was started with groundbreaking in Minot on April 5, 2002. Work began at Minot and proceeded toward Lake Sakakawea.

The Province of Manitoba filed suit in U.S. District Court to require the completion of an Environmental Impact Statement (EIS) for the NAWS project. The Bureau of Reclamation, through the Department of Justice and the State of North Dakota, is defending the case. The court has required the project undergo further NEPA review, and has placed a partial injunction on the project.

On April 15, 2005, the Court modified the injunction to allow the construction on the line between Lake Sakakawea and Minot to continue. All 45 miles of this pipeline were completed by the summer of 2008.

On March 6, 2006, the Bureau issued a Notice of Intent to initiate an environmental impact statement for the NAWS Project to evaluate alternative treatment methods and measures to minimize the risk of transferring non-native biota from the Missouri River basin to the Hudson Bay basin. The Notice provided for a 60-day scoping period during which the public was invited to provide oral or written comments. Public meetings were held in six cities. During the scoping process, Manitoba provided input to the Bureau concerning its views on treatment processes and treatment goals. As a result of the scoping process and review of public comments, the Bureau evaluated a range of treatment options, including those suggested by Manitoba, and developing corresponding cost estimates. Bureau released the draft EIS in December 2007 for public review and comment. There was a 60-day public comment period, which was extended for another 30 days accommodating Manitoba's request, and concluded in March 2008. The Final EIS was released in December 2008.

On March 24, 2006, the Court modified the injunction to allow additional construction of the Minot High Service Pump Station, the pipeline from the High Service Pump Station to the northern part of the City of Minot, and the pipeline to Berthold to proceed. It was determined that this construction would not affect treatment decisions. Design work on these projects was completed in 2006 and contract awards were made in 2007 and 2008. The pipeline projects were completed in 2008. Berthold started receiving water in August 2008. The High Service Pump Station is scheduled to be completed by the end of 2009.

On March 18, 2008, the Court again modified the injunction to allow additional design and construction activities for the entire Northern Tier for features not affecting treatment decisions. The Court required an annual status report at the end of each construction season. The Kenmare-Upper Souris and NAWS-All Seasons-Upham pipeline projects were awarded in October and November of 2008.

5.2 WATER APPROPRIATIONS

5.2.1 Background

In 1995, the International Souris River Board adopted a new method for reporting minor project diversions for the purpose of determining apportionment. The new method uses a common set of criteria and ensures that the same criteria will be used in both Saskatchewan and North Dakota. It

also involves taking the project lists generated by the Natural Flow Methods Committee and adding newly constructed projects or subtracting cancelled projects each year. The projects that met the criteria in 1993 are the benchmark for all future reporting.

5.2.2 Saskatchewan

In 1993, there were 137 minor projects in the Saskatchewan portion of the Souris River basin that met the new criteria. These projects had an annual diversion of 5 099 cubic decametres (4,134 acre-feet). On December 31, 2007, there were 139 minor projects in the Saskatchewan portion of the basin with an annual diversion of 4 824 cubic decametres (3,912 acre-feet). There were no new projects in 2008.

5.2.3 North Dakota

In 1993, there were 12 minor projects in the North Dakota portion of the Souris River basin upstream of Sherwood that met the new criteria. The projects had an annual diversion of 1 257 cubic decametres (1,019 acre-feet). On December 31, 2007, there were 11 minor projects in the North Dakota portion of the Long and Short Creek basins. The annual diversions totaled 1 316 cubic decametres (1,067 acre-feet). There were no new projects in 2008.

The diversion from East Branch Short Creek near Columbus, North Dakota, was estimated by correcting for precipitation, evaporation and seepage, and the storage change. The diversion in 2008 was 125 cubic decametres (101 acre-feet). The diversion from the reservoir was added to the minor project diversions for the Long and Short Creek basins to obtain the total diversion of 1 441 cubic decametres (1,168 acre-feet) by the United States.

6.0 HYDROLOGIC CONDITIONS IN 2008

Spring runoff in 2008 was well below normal in all areas of the Saskatchewan portion of the Souris River basin. The annual peak flow at Sherwood was about 294 cubic feet per second (8.3 cubic metres per second) on March 28, 2008, which ranked 63rd out of 79 years of record. Precipitation throughout the basin was well below normal from April through June and below normal for the remainder of the year.

Spring runoff in the North Dakota portion of the basin was well below normal. Precipitation in the Souris River basin in North Dakota ranged from less than 25 percent of normal in April to over 150 percent of normal in May. The lower end of the North Dakota portion of the Souris River basin received heavy precipitation in May and June resulting in increased flows in the Souris River.

Spring runoff in the Souris River basin in Manitoba was well below average as a result of below average soil moisture and snow cover. Precipitation was light in April but about average from early May to mid-July. Flows in the Souris River were above average from mid-June to mid-July due to releases from J. Clark Salyer National Wildlife Refuge.

On December 31, 2008, Rafferty Reservoir was at an elevation of 547.69 metres (1796.86 feet) which was 0.67 metres (2.20 feet) lower than at the beginning of the year. Total inflow to Rafferty Reservoir in 2008 was 992 cubic decametres (804 acre-feet), and the calculated diversion for 2008 was minus 6 865 cubic decametres (5,566 acre-feet). About 7 680 cubic decametres (6,226 acre-feet) of water was transferred from Rafferty Reservoir to Boundary Reservoir via the pipeline.

Releases were made from Alameda Reservoir from March 18 through April 11 in 2008. The main-stem inflow to Alameda Reservoir (Moose Mountain Creek above Alameda Reservoir) was 4 180 cubic decametres (3,389 acre-feet), and the calculated diversion for 2008 was minus 2 367 cubic decametres (1,919 acre-feet). Alameda Reservoir was at an elevation of 560.09 metres (1,837.54 feet) on December 31, 2008, or 0.63 metres (2.07 feet) less than at the beginning of the year.

Boundary Reservoir received an inflow of 205 cubic decametres (166 acre-feet) from Long Creek. The calculated diversion for 2008 was 5 817 cubic decametres (4,716 acre-feet). On December 31, 2008, Boundary Reservoir was at an elevation of 558.53 metres (1,832.43 feet), or 2.3 metres (7.55 feet) below Full Supply Level.

On December 31, 2008, the estimated storage in the five major reservoirs in Saskatchewan (Boundary, Rafferty, Alameda, Nickle Lake, and Moose Mountain Lake) was 467 278 cubic decametres (378,822 acre-feet) as compared to storage of 506 315 cubic decametres (410,476 acre-feet) on December 31, 2007. Figure 1 shows the storage contents of several reservoirs in the Canadian portion of the Souris River basin for 2007 and 2008.

Recorded runoff for the year for the Souris River near Sherwood was 16 930 cubic decametres (13,725 acre-feet), or about 15.5 percent of the 1931-2008 long-term mean. The artificially drained areas of Yellow Grass Ditch and Tatagwa Lake contributed 313 cubic decametres (254 acre-feet) during 2008. Figure 2 provides a schematic representation of recorded runoff above Sherwood, North Dakota.

On December 31, 2008, the level of Lake Darling was 484.58 metres (1,589.82 feet). The 2008 year-end storage in Lake Darling was 55 748 cubic decametres (45,195 acre-feet), or approximately 22 895 cubic decametres (18,560 acre-feet) less than on December 31, 2007. The 2008 year-end storage in the J. Clark Salyer Refuge pools was 37 339 cubic decametres (30,271 acre-feet), or 12 204 cubic decametres (9,894 acre-feet) more than on December 31, 2007. The combined year-end storage in Lake Darling and the J. Clark Salyer Refuge pools was 93 088 cubic decametres (75,466 acre-feet), well above the 66 600 cubic decametres (54,000 acre-feet) "severe drought" criterion. Figure 3 shows the storage contents of the main-stem reservoirs in the United States.

Recorded runoff for the year for the Souris River at Westhope was 11 649 cubic decametres (9,444 acre-feet) or some 5 281 cubic decametres (4,281 acre-feet) less than entered North Dakota at the Sherwood Crossing. The annual runoff for the Souris River near Westhope was 4.9 percent of the 1929-2008 long-term mean.

Figure 4 shows the monthly releases from Boundary, Rafferty, Alameda, and Lake Darling Reservoirs.

7.0 SUMMARY OF FLOWS AND DIVERSIONS

7.1 SOURIS RIVER NEAR SHERWOOD

The natural runoff near Sherwood for 2008 was 23 701 cubic decametres (19,214 acre-feet). Depletions in Canada totaled 5 644 cubic decametres (4,576 acre-feet). The additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins was 313 cubic decametres (254 acre-feet). Total depletions in Canada were 5 331 cubic decametres (4,322 acre-feet) more than the additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins. The total

volume of water released from Boundary, Rafferty, and Alameda Reservoirs in Canada in 2008 was 7 705 cubic decametres (6,246 acre-feet), representing 45.5 percent of the recorded flow at Sherwood, or 32.5 percent of the computed natural runoff at Sherwood. A schematic representation of the 2008 flow volumes in the Souris River basin above Sherwood is shown in Figure 2 and the summary of the natural flow computations is provided in Appendix A. It should be noted that Saskatchewan was in surplus on December 31, 2008 by 6 520 cubic decametres (5,286 acre-feet), not including the 2007 deficit of 1 773 cubic decametres (1,437 acre-feet).

The flow of the Souris River at Sherwood was more than 0.113 cubic metres per second (4 cubic feet per second) except during the periods of January 1 through March 11, and September 2 through December 31, 2007. During those periods when the flow was less than 0.113 cubic metres per second (4 cubic feet per second), the Province of Saskatchewan did not divert, store, or use any water above what would have occurred under conditions of water-use development prevailing in the Saskatchewan portion of the basin prior to the construction of Boundary Dam, Rafferty Dam, and Alameda Dam. Accordingly, Saskatchewan complied with the 0.113 cubic metres per second (4 cubic feet per second) provision specified in Recommendation No. 1 of the Interim Measures.

7.2 LONG CREEK AND SHORT CREEK

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 46 cubic decametres (37 acre-feet), or 0.2 percent of the long-term mean since 1959. Recommendation No. 2 of the Interim Measures was met with the increase of runoff on Long Creek between the Western and Eastern Crossings of 159 cubic decametres (129 acre-feet).

Short Creek, which rises in North Dakota, contributed 465 cubic decametres (377 acre-feet) to runoff in the Souris River above Sherwood.

7.3 SOURIS RIVER NEAR WESTHOPE

Recorded flow near Westhope during the period of June 1 through October 31, 2007, was 10 994 cubic decametres (8,913 acre-feet). Figure 5 illustrates the recorded flows at Westhope and at Wawanesa near the mouth of the Souris River in Manitoba.

There was zero flow in the Souris River near Westhope for the periods February 7 to March 23 and November 25 to December 31. The median daily discharge remained well below normal for most of the period. The instantaneous peak discharge of 149 cfs on June 18, ranked 66th, in 79 years of discharge record.

Except for the periods June 1 through June 16, July 13 through August 2, August 31 through September 30, and October 26 and 27, the flow was in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures. Because there was not enough water in the J. Clark Salyer pools to meet the minimum flow requirement, Eaton Irrigation District water rights, and the summer evaporative loss, a decision was made to release water from Lake Darling. On October 25-26 strong north winds pushed water in Pool 357 south, away from the dam gates. The water froze and refuge personnel had to break ice so water could flow through the gates. The Pool 357 gates were closed on November 3.

8.0 WORKPLAN SUMMARY FOR 2009

The International Souris River Board was created by the International Joint Commission in April 2000 when it combined responsibilities for the Souris River previously assigned in two separate References. The two were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948).

On June 9, 2005, the Board's mandate was changed further through an exchange of diplomatic notes, assigning water quality functions and the oversight for flood forecasting and operations to the Board. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

The Board determined that a work plan would be beneficial in helping the Board identify resource requirements and deliver on results. There was discussion on whether the workplan should include all activities or just special projects. The Board agreed that the workplan should include costs related to normal Board activities such as meetings, the annual report, and special projects. The three-year work plan for the International Red River Board was provided as an example.

A draft multi-year workplan was developed for 2008-2009 and will be updated for 2009-2010. The workplan is a follow-up to the four strategic initiatives of the International Watershed Initiative.

- Build shared understanding of the watershed and related transboundary issues.
- Communicate watershed issues at the local, regional and national levels to increase awareness, highlight potential issues, and identify opportunities for cooperation and resolution.
- Contribute to the resolution of watershed issues.
- Administer the existing orders and references.

Figure 1

MONTH END CONTENTS OF RESERVOIRS IN CANADA FOR THE YEARS 2007 AND 2008

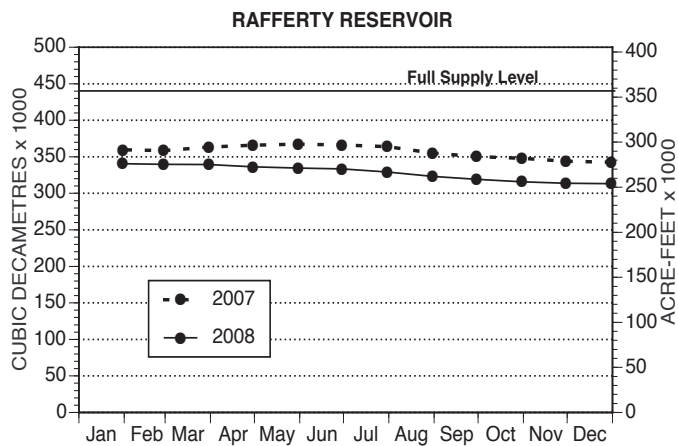
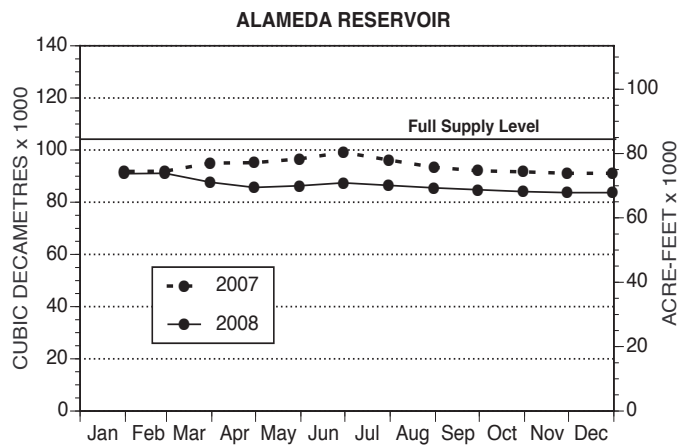
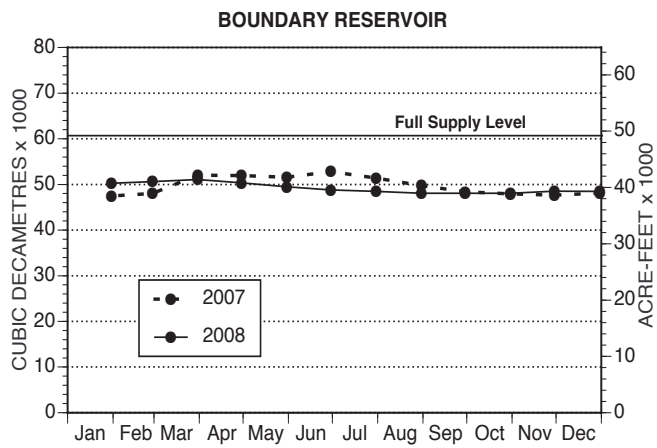
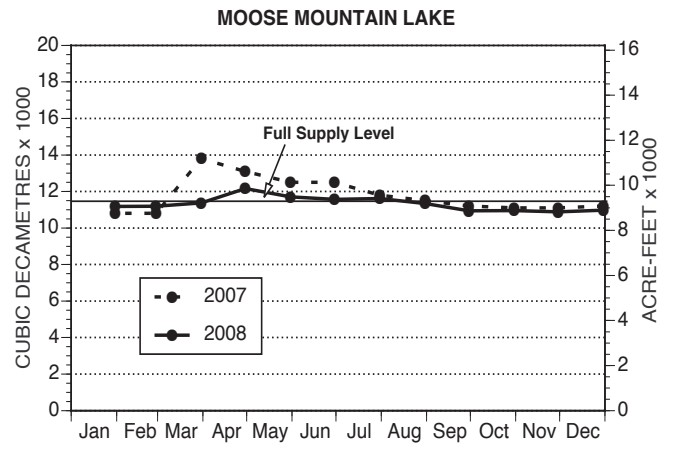
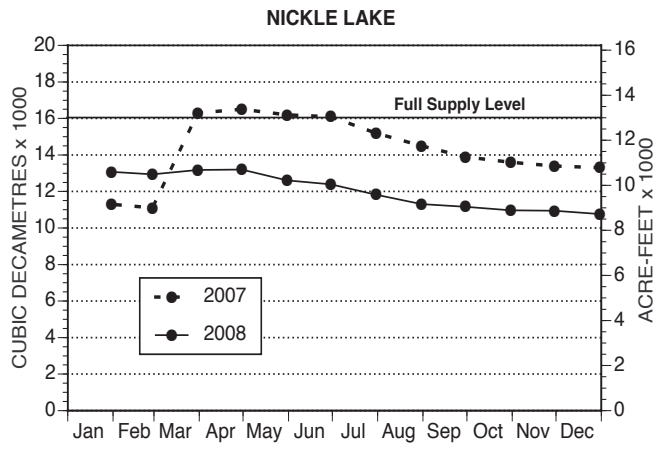


Figure 2

SCHEMATIC REPRESENTATION OF 2008 FLOWS IN THE SOURIS RIVER BASIN ABOVE SHERWOOD, NORTH DAKOTA, U.S.A.

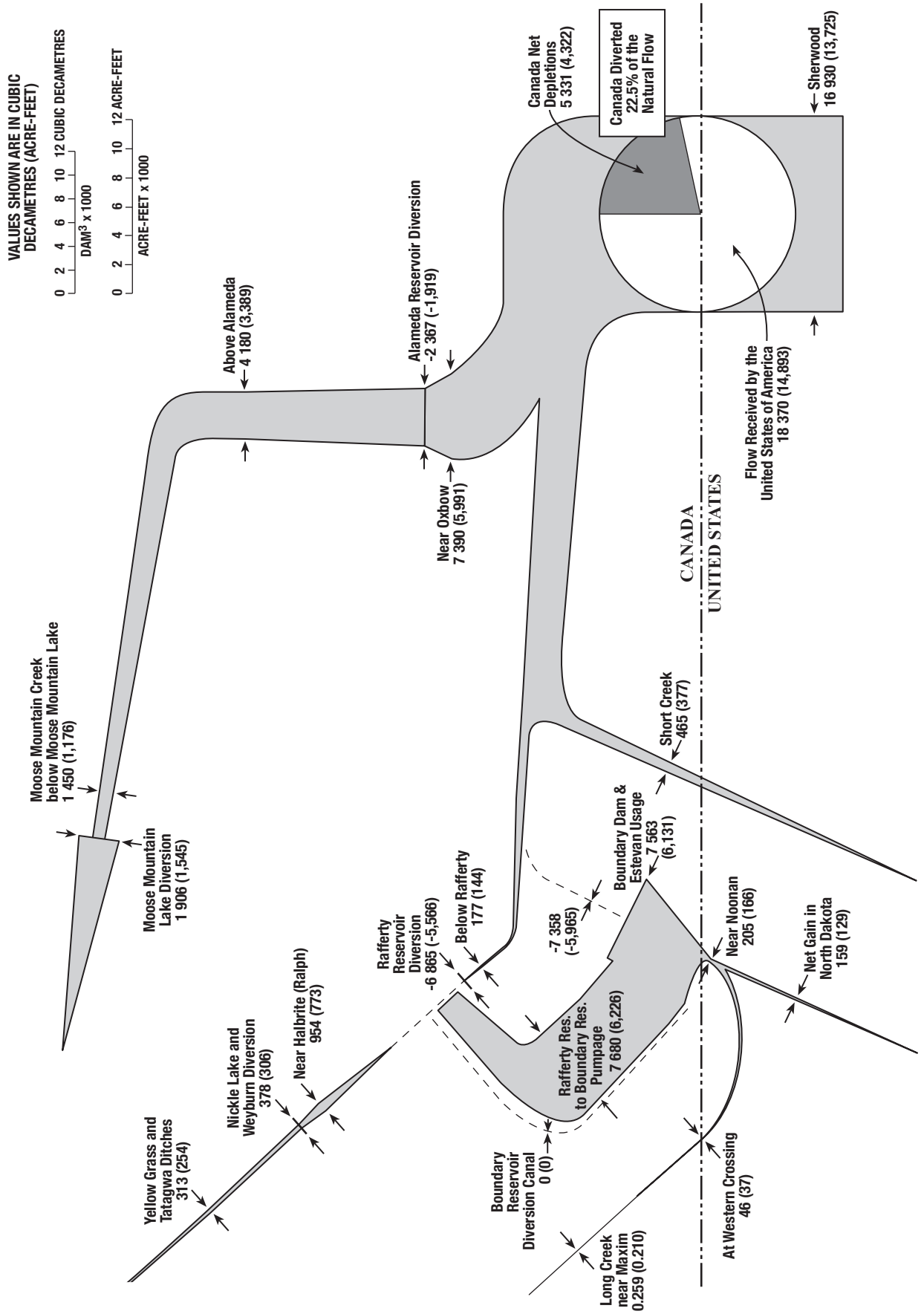


Figure 3

MONTH END CONTENTS OF RESERVOIRS IN USA FOR THE YEARS 2007 AND 2008

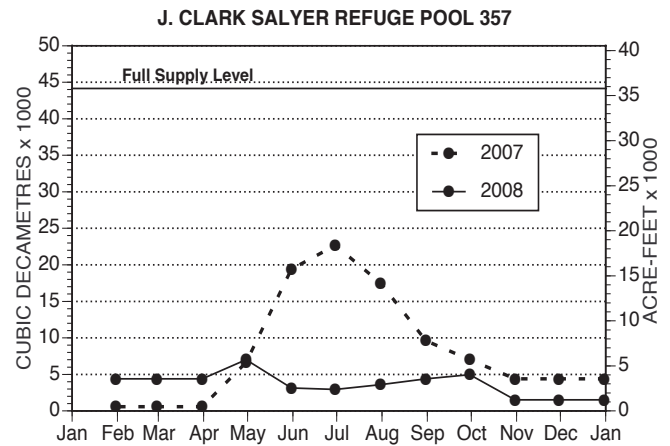
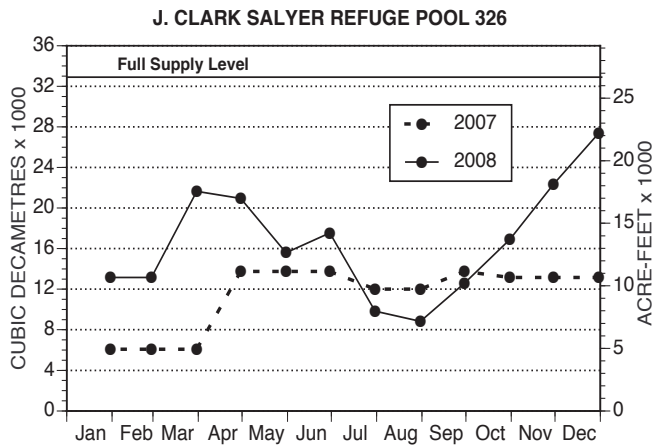
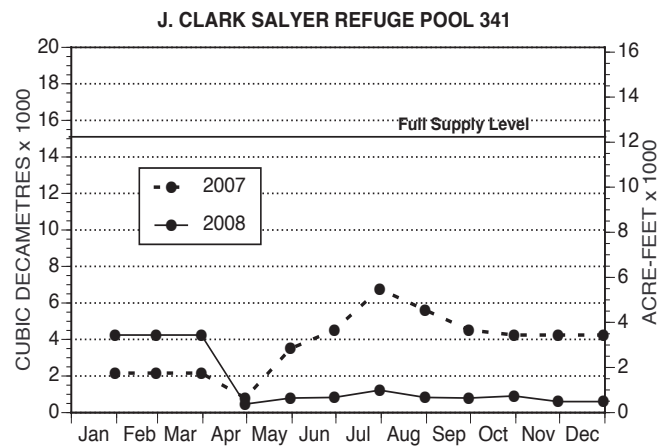
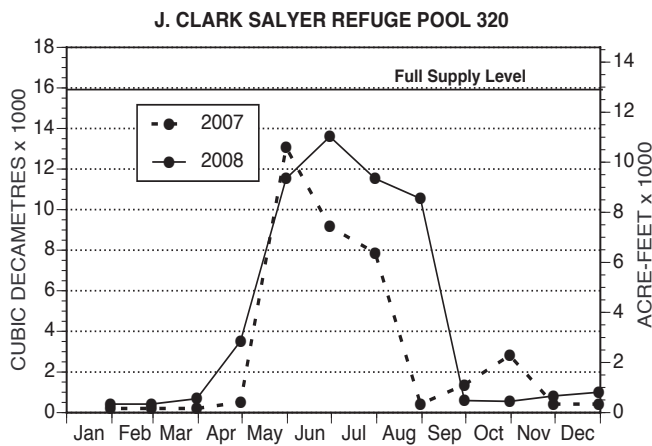
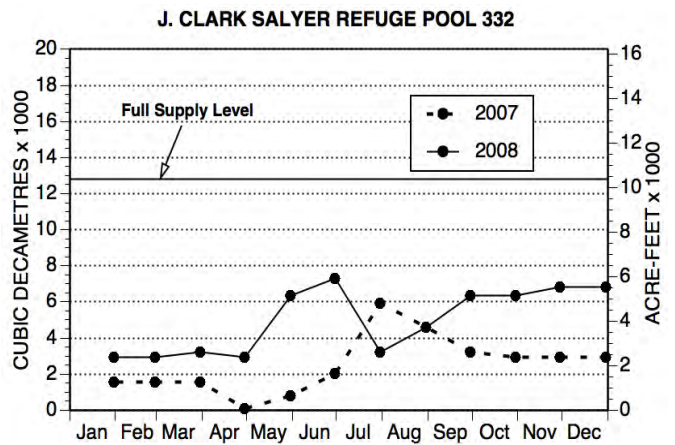
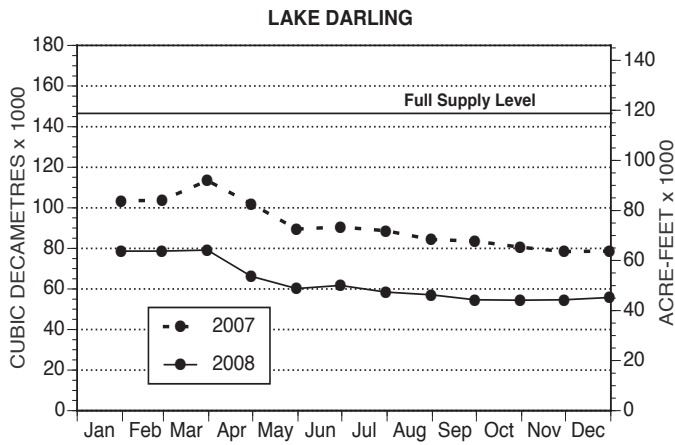
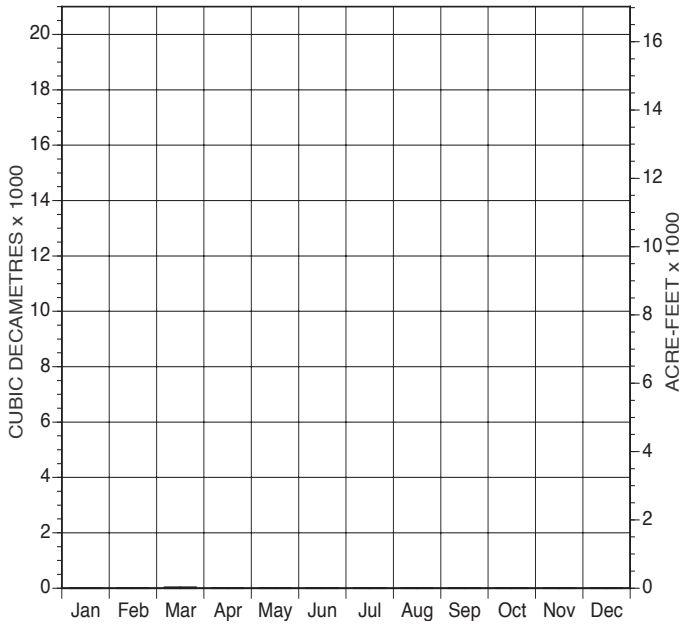


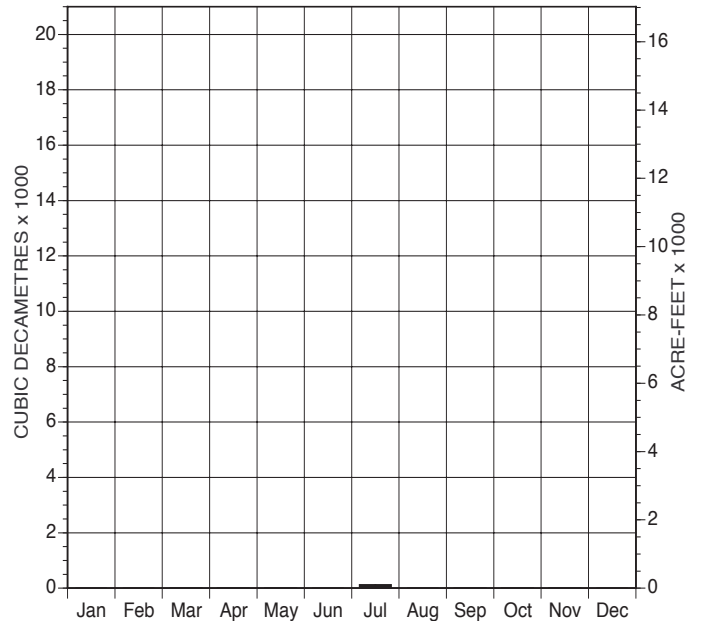
Figure 4

MONTHLY RESERVOIR RELEASES FOR THE YEAR 2008

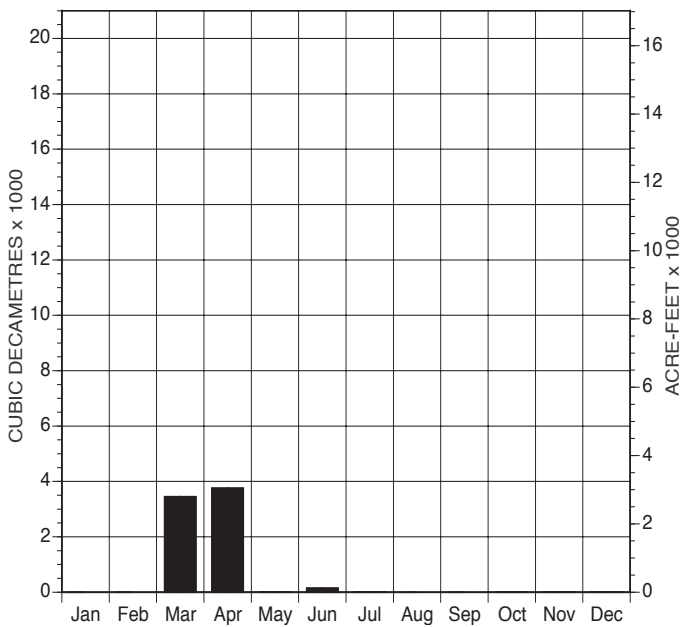
BOUNDARY DAM



RAFFERTY DAM



ALAMEDA DAM



LAKE DARLING DAM

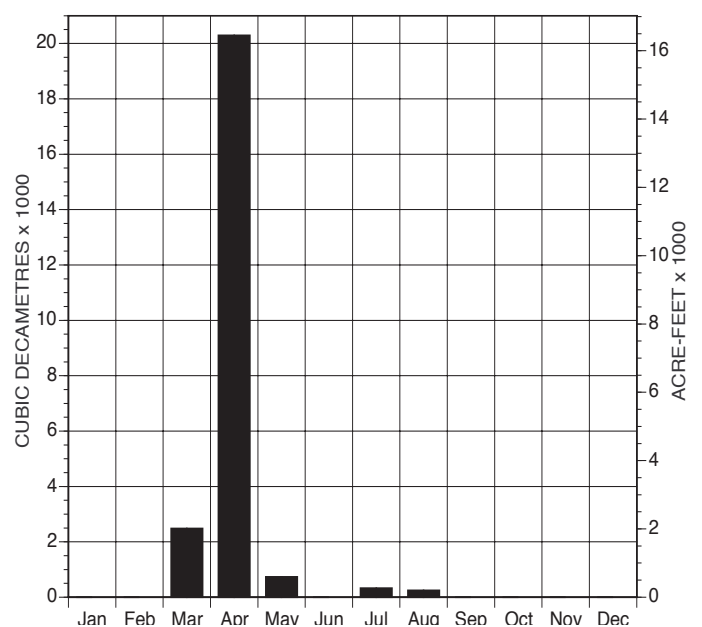
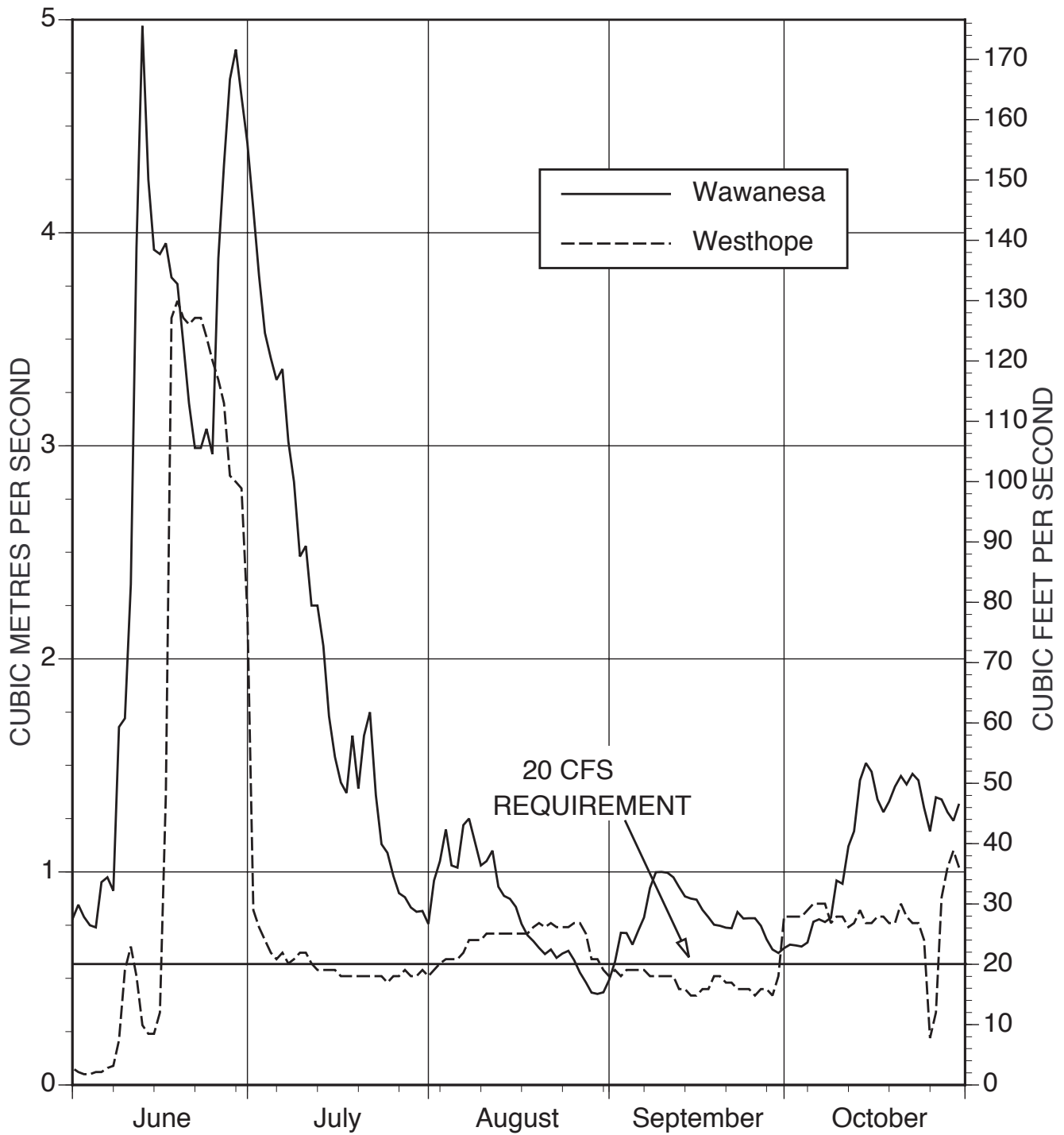


Figure 5

**SOURIS RIVER NEAR WESTHOPE
AND
SOURIS RIVER NEAR WAWANESA**

June 1, 2008 to October 31, 2008





APPENDIX A

Determination of Natural Flow of Souris River at International Boundary (Sherwood)

APPENDIX B

Equivalents of Measurements

EQUIVALENTS OF MEASUREMENTS

The following is a list of equivalents of measurement that have been agreed to for use in reports of the International Souris River Board.

1 centimetre equals 0.39370 inch

1 metre equals 3.2808 feet

1 kilometre equals 0.62137 mile

1 hectare equals 10 000 square metres

1 hectare equals 2.4710 acres

1 square kilometre equals 0.38610 square mile

1 cubic metre per second equals 35.315 cubic feet per second

The metric (SI) unit that replaces the British acre-foot unit is the cubic decametre (dam^3), which is the volume contained in a cube 10 m x 10 m x 10 m or 1 000 cubic metres.

1 cubic decametre equals 0.81070 acre-feet

1 cubic metre per second flowing for 1 day equals 86.4 cubic decametres

1 cubic foot per second flowing for 1 day equals 1.9835 acre-feet

APPENDIX C

Interim Measures as Modified in 2000

INTERIM MEASURES AS MODIFIED IN 2000

APPENDIX A TO THE DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the International Souris River Board. For the purpose of these calculations, any reference to "annual" and "year" is intended to mean the period January 1 through December 31.

For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metre per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River basin prior to construction of the Boundary Dam, Rafferty Dam, and Alameda Dam.

Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the annual natural flow volume at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control in North Dakota and of evaporation as a result of the project.

- a. Saskatchewan will deliver a minimum of 50 percent of the annual natural flow volume at the Sherwood Crossing in every year except in those years when the conditions given in (i) or (ii) below apply. In those years, Saskatchewan will deliver a minimum of 40 percent of the annual natural flow volume at the Sherwood Crossing.
 - i. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 486.095 metres (1594.8 feet); or
 - ii. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 485.79 metres (1593.8 feet), and since the last occurrence of a Lake Darling June 1 elevation of greater than 486.095 metres (1594.8 feet) the elevation of Lake Darling has not been less than 485.79 metres (1593.8 feet) on June 1.
- b. Notwithstanding the annual division of flows that is described in (a), in each year Saskatchewan will, so far as is practicable as determined by the Board, deliver to North Dakota prior to June 1, 50 percent of the first 50 000 cubic decametres (40,500 acre-feet) of natural flow which occurs during the period January 1 to May 31. The intent of this division of flow is to ensure that North Dakota receives 50 percent of the rate and volume of flow that would have occurred in a state of

nature to try to meet existing senior water rights.

- c. Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Projects' purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 485.79 metres (1593.8 feet) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 485.79 metres (1593.8 feet) on June 1.

Releases will not be made by Saskatchewan Watershed Authority from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 486.095 metres (1594.8 feet) on June 1.

- d. Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow.
 - e. A determination of the annual apportionment balance shall be made by the Board on or about October 1 of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31.
 - f. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the 0.113 cubic metre per second (4 cubic feet per second) minimum flow limit, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Watershed Authority, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.
2. Except as otherwise provided herein with respect to delivery of water to the Province of Manitoba, the State of North Dakota shall have the right to divert, store, and use the waters which originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing under Recommendation (1) above; provided, that any diversion, use, or storage of Long Creek water shall not diminish the annual flow at the eastern crossing of Long Creek into Saskatchewan below the annual flow of said Creek at the western crossing into North Dakota.

3. (a) In addition to the waters of the Souris River basin which originate in the Province of Manitoba, that Province shall have the right, except during periods of severe drought, to receive for its own use and the State of North Dakota shall deliver from any available source during the months of June, July, August, September, and October of each year, six thousand and sixty-nine (6,069) acre-feet of water at the Westhope Crossing regulated so far as practicable at the rate of twenty (20) cubic feet per second except as set forth hereinafter: provided, that in delivering such water to Manitoba no account shall be taken of water crossing the boundary at a rate in excess of the said 20 cubic feet per second.

(b) In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use. It is understood that in the circumstances contemplated in this paragraph the State of North Dakota will give the earliest possible advice to the International Souris River Board of Control with respect to the onset of severe drought conditions.
4. In event of disagreement between the two sections of the International Souris River Board of Control, the matters in controversy shall be referred to the Commission for decision.
5. The interim measures for which provision is herein made shall remain in effect until the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the Reference of January 15, 1940, unless before that time these interim measures are qualified or modified by the Commission.

APPENDIX D

Board Directive from January 18, 2007

DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board was created by the International Joint Commission in April 2000 when it amalgamated the Souris River basin responsibilities previously assigned to the Commission in two separate references by the governments of Canada and the United States. The two references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948). The International Souris River Board's mandate changed further through an exchange of diplomatic notes on June 9, 2005 assigning water quality functions and the oversight for flood forecasting and operations as described in Section 4 below. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the International Souris River Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

This directive replaces the April 11, 2002 Directive to the International Souris River Board and sets out the mandate under which the Board will operate.

1. Pursuant to the Boundary Waters Treaty of 1909 and related agreements, responsibilities have been conferred on the Commission to ensure compliance with apportionment measures for the waters of the Souris River, to investigate and report on water requirements and uses as they impact the transboundary waters of the Souris River basin, and to assist in the implementation and review of the Joint Water Quality Monitoring Program pursuant to the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.
2. The apportionment measures derive from the approvals given by the governments of Canada and the United States, by letters of March 20, 1959 and April 3, 1959 respectively, to the recommendations made by the Commission in paragraph 22 of its report to the governments of March 19, 1958. Subsequently, with the signing of the Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin on October 26, 1989 (hereafter referred to as the 1989 Agreement), the Interim Measures for apportionment of the Souris River at the Saskatchewan-North Dakota boundary were revised as described in Annex B of the 1989 Agreement. By letters of February 28, 1992, the Commission was requested to monitor compliance with the measures as modified in the 1989 Agreement. By letters of December 20 and 22, 2000, the governments amended Annex B of the 1989 Agreement. The attached Appendix A is a consolidation of the apportionment measures against which the Commission is to monitor compliance.
3. By letters of January 12, 1948, the governments requested the Commission to undertake investigations of water requirements and uses arising out of existing dams and other works or projects in the mid-continent portion of the Canada-United States boundary, including the Souris River basin, and to make advisory recommendations.

4. By exchange of diplomatic notes between the governments of Canada and the United States dated January 14 and June 9, 2005, the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin was formally revised to include a reference pursuant to Article IX of the Boundary Waters Treaty which assigned water quality responsibilities contained in the 1989 Agreement to the Commission. The Commission was requested to assist with the implementation and review of the Joint Water Quality Monitoring Program. On October 21, 2005 at the October 2005 Commission's meeting with governments, the U.S. State Department read a statement into the Commission's formal record that the U.S. State Department is of the opinion the Commission has the authority and has obtained the notification it needs from the U.S. State Department to proceed with carrying out the flood related responsibilities for the Souris River. On April 6, 2006 at the April 2006 Commission's meeting with governments, the Department of Foreign Affairs and International Trade indicated that the Board should be assigned these responsibilities. It is recognized that Article X of the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin designates the entities responsible for operation and maintenance of the improvements mentioned in the 1989 Agreement and that the operations will be in accordance with the Operating Plan shown in Annex A of the 1989 Agreement. The Department of Army is the entity designated responsible for flood operations within the United States. The Government of Saskatchewan is the Canadian entity designated responsible for flood operations within the Canadian Province of Saskatchewan.

5. The Board's mandate is to support the Commission's initiative to explore and encourage the development of local and regional capacity with the objective of preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Souris River and its tributaries and aquifers. This would be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Souris River basin. The Board's mandate will be accomplished by performing the tasks identified in Clause 6 below.

6. The Board's duties shall be to:
 - (i) Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

 - (ii) Oversee the implementation of compliance with the Interim Measures As Modified For Apportionment of the Souris River as described in Appendix A of this document by:
 - identifying an adequate hydro-climatic monitoring network to support the determination of natural flow and apportionment balance,
 - encouraging the appropriate authorities to establish and maintain hydro-climatic monitoring and information collection networks and reporting

systems to ensure suitable information is available as required for the determination of natural flow and apportionment balance,

- informing the Commission, in a timely manner, of critical water supply or flow conditions in the basin,
- encouraging appropriate authorities to take steps to ensure that apportionment measures are met, and
- preparing an annual report and submitting it to the Commission.

(iii) Assist the Commission in the review of a Joint Water Quality Monitoring Program (referred to hereafter as “the Program”) by:

- developing recommendations on the Program and the setting of water quality objectives,
- exchanging data provided by the Program on a regular basis,
- collating, interpreting, and analyzing the data provided by the Program,
- reviewing the Program and the water quality objectives at least every five years and developing recommendations, as appropriate, to the Commission to improve the Program and the objectives, and
- preparing an annual report containing:
 - a summary of the principal activities of the Board during the year with respect to the Program,
 - a summary of the principal activities affecting water quality in the Souris River Basin during the year,
 - a summary of the collated, interpreted, and analyzed data provided by the Program,
 - a summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary,
 - a section summarizing any definitive changes in the monitored parameters and the possible causes of such changes,
 - a section discussing the water quality objectives for the Souris River at the Saskatchewan/North Dakota boundary and at the North Dakota/Manitoba boundary as established and revised pursuant to the 1989 Agreement,
 - a section summarizing other significant water quality changes and the possible causes of such changes, and
 - recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under the 1989 Agreement.

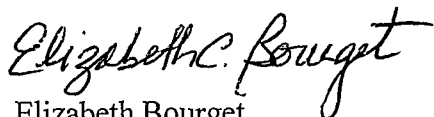
(iv) Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin by:

- ensuring mechanisms are in place for coordination of data exchange, flood forecasts and communications related to flood conditions and operations;
 - determining whether the operations under the 1989 Agreement should proceed based on the Flood Operation or Non-Flood Operation of the Operating Plan, which is Annex A to the 1989 Agreement, using its criteria and informing designated agencies of this determination;
 - reporting to the Commission on any issues related to flood operations and management; and
 - providing the Commission and the designated entities under the 1989 Agreement recommendations on how flood operations and coordination activities could be improved.
- (v) Report on aquatic ecosystem health issues in the watershed, regularly informing the Commission on the state and implications of aquatic ecosystem health, and encourage the appropriate authorities to establish and maintain water quality and other monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of the health of the aquatic ecosystem.
- (vi) Carry out such other studies or activities as the Commission may, from time to time, request.
- (vii) Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year. The work plan shall be submitted annually to IJC for review.
7. The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year.
8. The Board shall coordinate and collaborate with other agencies and institutions both within and outside the Souris River basin as may be needed or desirable, and facilitate the timely dissemination of pertinent information within the basin. The Board shall keep the Commission informed of these activities.
9. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Appointments may be renewed for additional terms. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint Canadian and United States co-chairs of the Board and will strive to appoint chairs with complementary expertise that encompasses a broad spectrum of basin issues.
10. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and among the Board members.

11. The co-chairs shall ensure that members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.
12. The co-chairs may appoint secretaries of the Board who, under the general supervision of the co-chairs, shall carry out such duties as are assigned by the co-chairs or the Board as a whole.
13. The Board may establish such committees and working groups as may be required to fulfill its responsibilities in a knowledgeable and effective manner. The Commission shall be kept informed of the duties and composition of any committee or working group.
14. Unless other arrangements are made with the Commission, members of the Board, committees, or working groups shall make their own arrangements for reimbursement of necessary expenditures for travel or other related expenses.
15. The Board shall inform the Commission in advance of plans for any meetings, or other means of involving the public in Board deliberations, and shall report to the Commission, in a timely manner, on these and any other presentations or representations made to the Board.
16. The Board shall conduct its public outreach activities in accordance with the Commission's public information policies and shall maintain files in accordance with the Commission policy on segregation of documents.
17. Prior to their release, the Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers.
18. The Board shall submit an annual report covering all of its activities, including the annual report regarding the Program and the work plan, as described in Section 6 above, to the Commission, at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive. Reports shall be submitted in a format suitable for public release and electronic copies shall be provided to each of the Commission's section offices.
19. Reports, including annual reports, minutes and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by the Commission. The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's web site.

20. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.
21. The Board shall operate by consensus. In the event of any disagreement among the members of the Board which they are unable to resolve, the Board shall refer the matter forthwith to the Commission for decision.
22. The Commission may amend existing instructions or issue new instructions to the Board at any time.

Signed this 18th day of January, 2007



Elizabeth Bourget
Secretary
United States Section



Murray Clamen
Secretary
Canadian Section

APPENDIX E

Water Quality Data for Sherwood and Westhope

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER – NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2008 (Jan 1- Dec 31)
STATION 05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA* Median(max-min)#samples	ANNUAL DATA Median(max-min)#samples	PERCENT EXCEEDANCE
Biological Parameters					
Fecal Coliform	200/100 ml	#/100 ml	30(8300-<1)196	NDA	0
Inorganic Parameters					
Ammonia (un-ionized as NH3)	****	mg/L	0.002(0.056-<0.001)62	NDA	0
Chloride	100	mg/L	47(220-4)304	56.6(125.7-47.9)7	0
Fluoride	1.5	mg/L	0.2(1.8-<0.1)304	0.24(0.44-0.18)7	0
NO ₂ + NO ₃ (as N)dissolved	1.0	mg/L	0.05(1.4-<0.01)266	<0.06(<0.06-<0.06)7	0
Phosphorus(total P)	0.10	mg/L	0.18(1.9-0.02)343	0.74(1.5-0.09)7	86
Sodium	100	mg/L	120(507-14)302	202(507-142)7	57
Sulfate	450	mg/L	230(1000-45)304	292(829-261)7	29
Arsenic (total)	0.05	mg/L	0.003(0.028-.001)139	.006(0.012-<0.002)7	0
Barium(total)	1.0	mg/L	<0.2(0.3-<0.1)138	0.04(0.14-0.02)7	0
Boron(total)	0.50	mg/L	0.21(3.5-0.04)136	0.2(0.21-0.14)7	0
Beryllium(total)	0.10	mg/L	<0.010(0.04-<0.001)138	<0.001(<0.001-<0.001)7	0
Cadmium(total)	***27	µg/L	<1(.42-<.04)137	0.04(0.07-<0.02)7	0
Chromium(total)	50	µg/L	<1(30-<0.8)137	0.37(0.8-<0.4)7	0

***based on hardness of 300 mg/L
****unionized ammonia is calculated using temperature and pH
NDA: No Data Available
NC: Not Calculated

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER – NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2008 (Jan 1- Dec 31)
STATION 05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA Median(max-min)#samples	ANNUAL DATA Median(max-min)#samples	PERCENT EXCEEDANCE
Cobalt(total)	0.05	mg/L	<0.002(0.002-<0.001)138	<0.001(0.002-<0.001)7	0
Copper(total)	***30	µg/L	2.4(19-<1)137	1.3(2.1-0.9)7	0
Iron(total)	0.3	mg/L	0.53(10.0-0.02)146	0.45(0.47-0.2)7	57
Lead(total)	***13	µg/L	0.3(7-<1)137	0.22(0.71-0.14)7	0
Mercury	0.5 ug/g in fish flesh	µg/g	NDA	NDA	NDA
Molybdenum(total)	0.01	mg/L	0.002(0.045-<0.001)133	0.002(0.004-0.002)7	0
Nickel(total)	***220	µg/L	4(17-1)192	3.2(5.4-2.5)7	0
Selenium(total)	0.005	mg/L	<0.001(0.003-<0.001)138	<0.001(<0.001-<0.001)7	0
Zinc(total)	30	µg/L	7(620-<2)190	1.61(2.7-1.2)7	0
Miscellaneous					
Total Dissolved Solids	1000	mg/L	746(2540-170)371	926(2417-900)7	29
Total Suspended Solids	the lesser of 10 mg/L or 10% over ambient	mg/L	NDA	NDA	NDA
pH (range)	8.5-6.5	standard units	8.1(9.2-6.9)420	8.9(9.2-7.9)7	14
Dissolved Oxygen (conc.)	>5.0	mg/L	8.0(19.4-0.0)407	9.4(13.6-1.8)7	14
Aesthetics		visual	NDA	NDA	NDA
Oil and Grease		visual	NDA	NDA	NDA

*** based on a hardness of 300 mg/L
NDA: No Data Available
NC: Not Calculated

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER – NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2008 (Jan 1- Dec 31)
STATION 05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA Median(max-min)#samples	ANNUAL DATA Median(max-min)#samples	PERCENT EXCEEDANCE
Organic Parameters					
Atrazine	2	µg/L	<0.05(0.03-<0.001)12	NDA	NDA
Bromoxynil	5	µg/L	NDA	NDA	NDA
Carbaryl	90	µg/L	<0.003(<0.003)10	NDA	NDA
Chlordane	0.0043	µg/L	<0.10(0.10-<0.10)40	NDA	NDA
DDT	0.001	µg/L	<0.01(0.02-<0.01)40	NDA	NDA
Dieldrin	0.0019	µg/L	<0.01(0.03-<0.01)40	NDA	NDA
Dicamba	IN DEVELOPMENT	µg/L	<0.01(<0.01)3	NDA	NDA
Diclofop-methyl	IN DEVELOPMENT	µg/L	NDA	NDA	NDA
Heptachlor	0.0038	µg/L	<0.01(0.15-<0.01)40	NDA	NDA
MCPA	0.20	µg/L	NDA	NDA	NDA
Parathion	0.04	µg/L	<0.01(<0.01)40	NDA	NDA
Picloram	0.05	µg/L	<0.01(<0.01)3	NDA	NDA
Phenols(total)	1.0	µg/L	1(19-<1)195	<16(<16-<16)7	0
Polychlorinated biphenyl (total)	0.001	µg/L	<0.1(0.3-<0.1)39	NDA	NDA
Triallate	0.57	µg/L	<0.001(0.035-<0.001)10	NDA	NDA
Trifluralin	0.10	µg/L	<0.002(0.084-<0.002)10	NDA	NDA
2,4-D	4.0	µg/L	0.02(0.24-<0.01)26	NDA	NDA

NDA: No Data Available

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER – NORTH DAKOTA/MANITOBA BOUNDARY 2008 (Jan 1- Dec 31)
00US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA* Median(max-min)#samples	ANNUAL DATA -2003 Median(max-min)#samples	PERCENT EXCEEDANCE
Biological Parameters					
Fecal Coliform	200/100 ml	#/100 ml	<10(2300-<2)388	18(406-<2)10	40
Inorganic Parameters					
Ammonia (un-ionized as NH3)	****	mg/L	0.005(0.433-0)173	0.027(0.064-0.005)7	0
Chloride	100	mg/L	28(236-1.2)524	73.8(236-37.8)7	14.3
Fluoride	1.5	mg/L	0.21(0.98-<0.01)571	0.26(0.35-0.18)6	0
NO ₂ + NO ₃ (as N)dissolved from 1990	1.0	mg/L	<0.01(1.11-<0.01)160	0.019(0.085-<0.01)9	0
Phosphorus(total P) from 1990	0.10	mg/L	0.31(4.04-0.091)157	0.295(1.59-0.23)9	100
Sodium	100	mg/L	114(1040-6.4)769	274(1040-147)7	100
Sulfate	450	mg/L	183(3490-4.8)769	626(3490-530)7	100
Arsenic (total)	0.05	mg/L	0.0004(0.0334-0.0005)336	0.0112(0.0334-0.0055)7	0
Barium(total)	1.0	mg/L	0.1(0.499-<0.04)242	0.0846(0.292-0.0544)7	0
Boron(total)	0.50	mg/L	0.2345(2.08-<0.002)328	0.314(0.972-0.196)7	14.3
Beryllium(total)	0.10	mg/L	0.0000895(<0.0005-0.000004)126	0.000063(0.000091-0.000013)7	0
Cadmium(total)	***27	µg/L	<0.25(5-0.009)278	0.061(0.012-0.038)7	0
Chromium(total)	50	µg/L	<1(2.36-<0.015)124	1.46(2.36-0.293)7	0
Cobalt(total)	.05	mg/L	<0.001(0.009-0.0002)245	0.0017(0.00497-0.000923)7	0

***based on hardness of 300 mg/L
****un-ionized ammonia is calculated using temperature and pH
NDA: No Data Available

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER – NORTH DAKOTA/MANITOBA BOUNDARY 2008 (Jan 1-Dec 31)
00US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA Median(max-min)#samples	ANNUAL DATA Median(max-min)#samples	PERCENT EXCEEDANCE
Copper(total)	***30	µg/L	2(38-0.6)276	3.44(4.59-1.44)7	0
Iron(total)	0.3	mg/L	0.0955(14.5-<0.007)304	1.7(14.5-0.323)7	100
Lead(total)	***13	µg/L	1.5(6.7-0.098)274	1.4(5.17-0.359)7	0
Mercury	0.5 ug/g in fish flesh	µg/g		NDA	
Molybdenum(total)	0.01	mg/L	0.00279(0.0352-0.0006)123	0.01(0.0352-0.0042)7	0
Nickel(total)	***220	µg/L	3.3(24.7-1.6)278	8.36(24.7-5.15)7	0
Selenium(total)	0.005	mg/L	0.00040.002-<0.00005)335	0.00072(0.00181-0.00047)7	0
Zinc(total)	30	µg/L	2.83(32-0.5)271	6.19(10.4-1.27)7	0
Miscellaneous					
Total Dissolved Solids	1000	mg/L	749(3299-129)244	1334.9(1595.4-1093.4)6	100
Total Suspended Solids	the lesser of 10 mg/L or 10% over ambient	mg/L	17(300-<1)556	52(107-29)9	100
pH (range)	8.5-6.5	standard units	8.3(9.85-6.8)442	8.485(8.8-7.82)8	50
Dissolved Oxygen (conc.)	>5.0	mg/L	8.3(21.6-0)444	5.53(15.6-0.47)7	29
Aesthetics		visual	NDA	NDA	NDA
Oil and Grease		visual	NDA	NDA	NDA

*** based on a hardness of 300 mg/L
NDA: No Data Available

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER – NORTH DAKOTA/MANITOBA BOUNDARY 2008 (Jan 1-Dec 31)
00US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA Median(max-min)#samples	ANNUAL DATA Median(max-min)#samples	PERCENT EXCEEDANCE
Organic Parameters					
Atrazine	2	µg/L	<0.05(2.4-<0.003)123	0.00784(0.0125-<0.00323)4	0
Bromoxynil	5	µg/L	<0.02385(0.202-<0.00099)96	0.00145(0.0101-<0.00133)4	0
Carbaryl	90	µg/L			
a-Chlordane	0.0043	µg/L	<0.003(0.003-<0.00014)212	<0.0006(<0.0006-<0.0006)4	0
g-Chlordane	0.0043	µg/L	<0.002(<0.002-<0.00004)213	<0.00031(<0.00031-<0.00031)4	0
o,p-DDT	0.001	µg/L	<1(<4.0-<.00004)214	<0.00056(0.0027-<0.00056)4	0
Dieldrin	0.0019	µg/L	<0.002(<0.002-<0.00018)251	<0.00107(<0.00107-<0.00107)4	0
Dicamba	IN DEVELOPMENT	µg/L	<0.03(0.0451-<0.00073)133	<0.00089(<0.00089-<0.00089)4	0
Diclofop-methyl	IN DEVELOPMENT	µg/L	<0.05(<0.05-<0.0034)108	<0.00735(<0.00735-<0.00735)4	0
Heptachlor	0.0038	µg/L	<0.001(0.004-<0.00014)249	<0.00056(<0.00056-<0.00056)4	0
MCPA	0.20	µg/L	<0.1145(0.7-<0.00058)258	0.02871(0.118-<0.00132)4	0
Parathion	0.04	µg/L	<0.0155(<0.088-<0.0155)25	NDA	0
Picloram	0.05	µg/L	<0.05(<0.2-<0.00033)197	<0.00217(<0.00217-<0.00217)4	0
Phenols(total)	1.0	µg/L			
Polychlorinated biphenyl (total)	0.001	µg/L	<0.0033(<0.0102-<0.00021)23	<0.00034(<0.00034-<0.00034)4	0
Triallate	0.57	µg/L	<0.01(0.072-0.0013)115	<0.00222(<0.00222-<0.00222)4	0
Trifluralin	0.10	µg/L	<0.005(0.01-<0.00266)119	<0.00266(<0.00266-<0.00266)4	0
2,4-D	4.0	µg/L	<0.03(0.587-<0.00047)262	0.03185(0.0833-0.0105)4	0

NDA: No Data Available

APPENDIX F

Water Quality Monitoring Plan for Sherwood and Westhope

1. Sherwood Monitoring Plan

Season	No. of Site Visits	No. of Samples Per Year			
		Dissolved Oxygen	Major Ions	Nutrients	Trace Elements
1(March through June)	3	3	3	3	3
2(July through October)	2	2	2	2	2
3(November through February)	2	2	2	2	2
TOTAL	7	7	7	7	7

2. Westhope Monitoring Plan

Season	No. of Site Visits	No. of Samples Per Year				
		Dissolved Oxygen	Major Ions	Nutrients	Trace Elements	Pesticides
1(March through June)	3	3	3	2	3	3
2(July through October)	3	3	2	3	2	1
3(November through February)	2	2	2	2	2	
TOTAL	8	8	7	7	7	4

